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(54) HIGH POLYMER SOLID ELECTROLYTE FOR HARDENING ACTIVE ENERGY LINE AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a solid electrolyte forming material which dispenses with using a photopolymerization agent, which handens at practical light strength and light radiation amount and is liquid at ordinary temperature and provide such a hardening method by providing a (poly)alkylene glycol derivative with at least one maleimide group in its electrolyte and a molecule.

SOLUTION: This is a compound represented by a formula, In the formula, m and n are respectively independently integers of 0-6, and m+n is an integer of 1-6. R11 and R12 are respectively independently hydrocarbon linkages containing an aliphatic group and/or an aromatic group. G1 and G2 are respectively independently ether linkage, ester linkage, urethane linkage, or carbonate linkage. R2 is an ether linkage chain or a (poly)ether residue with 44-10000 average molecular weight where straight chain or branch alkylene groups are coupled by the ether linkage. It is preferable that (poly)alkylene glycol derivative has two or more polymeric functional groups in molecule, and at least one of the polymeric functional groups is a maleimide group.

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CLAIMS

[Claim(s)]

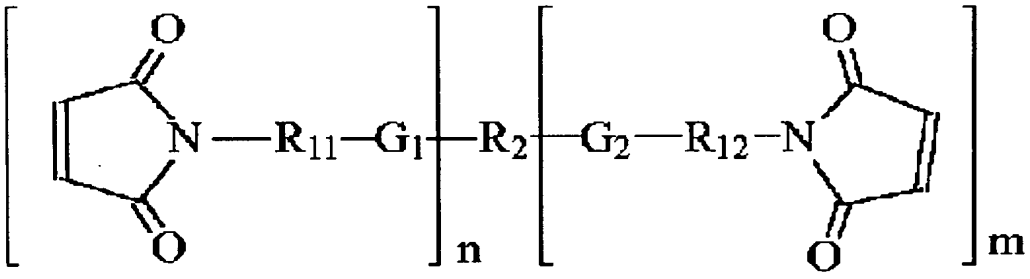
[Claim 1] (1) The solid polymer electrolyte formation ingredient characterized by containing the alkylene glycol derivative which has at least one maleimide radical in an electrolyte and (2) molecules (Pori).

[Claim 2] Furthermore, the solid polymer electrolyte formation ingredient containing the alkylene glycol derivative whose at least one of the polymerization nature functional groups it is the alkylene glycol derivative which has two or more polymerization nature functional groups in a molecule (Pori), and is a maleimide radical (Pori) according to claim 1.

[Claim 3] (1) the alkylene glycol derivative which has one maleimide radical in a molecule (Pori) -- and -- Solid polymer electrolyte formation ingredient containing the alkylene glycol derivative whose at least one of the polymerization nature functional groups it is the alkylene glycol derivative which has two or more polymerization nature functional groups in (2) molecules (Pori), and is a maleimide radical (Pori) according to claim 1.

[Claim 4] The alkylene glycol derivative which has at least one maleimide radical in a molecule (Pori) is a general formula (1).

[Formula 1]



(1)

(Among a formula, although m and n express the integer of 0-6 which became independent respectively, m+n expresses the integer of 1-6.) R11 and R12 express respectively independently hydrocarbon association containing an aliphatic series radical and/or an aromatic series radical. G1 and G2 express respectively independently ether linkage, an ester bond, a urethane bond, and carbonate association. R2 A straight chain or a branching alkylene group expresses the ether (Pori) joining chain or (Pori) ether residue of average molecular weight 44-10,000 connected with ether linkage. Solid polymer electrolyte formation ingredient given in any 1 term of claim 1 which is the compound expressed thru/or the 3rd term.

[Claim 5] Furthermore, a solid polymer electrolyte formation ingredient given in any 1 term of claims 1-4 which are compounds other than the alkylene glycol derivative which has a maleimide radical (Pori), and contain the compound which has a maleimide radical and copolymeric.

[Claim 6] The solid polymer electrolyte formation ingredient according to claim 5 which are one or more sorts of compounds with which the compound which has

a maleimide radical and copolymeric is chosen from the group which is the vinyl ether compound which has the acrylic ester which has ** (Pori) alkylene glycol chain (meta), and ** (Pori) alkylene glycol chain.

[Claim 7] if an electrolyte chooses from an alkali-metal salt, quarternary ammonium salt, the 4th class phosphonium salt, and a transition-metals salt -- **** -- the solid polymer electrolyte formation ingredient of claim 1-6 which contains one sort of electrolytes even if few given in any 1 term.

[Claim 8] The solid polymer electrolyte formation ingredient of claim 1-7 containing a nonaqueous organic solvent given in any 1 term.

[Claim 9] The solid polymer electrolyte formation ingredient according to claim 8 which are at least one sort of non-aqueous solvents chosen from the group which a nonaqueous organic solvent becomes from a carbonate, lactone, and the ether.

[Claim 10] The solid polymer electrolyte characterized by becoming any 1 term of claims 1-9 from the hardened material of the solid polymer electrolyte formation ingredient of a publication.

[Claim 11] The hardening approach of the solid polymer electrolyte formation ingredient characterized by carrying out the polymerization of this solid polymer electrolyte formation ingredient to a solid polymer electrolyte formation ingredient given in any 1 term of claims 1-9 by irradiating an activity energy line

under un-existing [of a photopolymerization initiator].

[Claim 12] The hardening approach according to claim 11 that activity energy lines are ultraviolet rays.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the hardening approach of the solid polymer electrolyte which consists of the activity energy-line hardenability solid polymer electrolyte formation ingredient and this activity energy-line hardenability solid polymer electrolyte formation ingredient containing the specific maleimide derivative hardened by the ultraviolet rays of a practical exposure under un-existing [of a photopolymerization initiator] in more detail about a useful solid polymer electrolyte or a gel solid polymer electrolyte to a lithium ion battery, a lithium metal cell, an electric double layer capacitor, an electrochromic element, a solar battery, etc., and this activity energy-line hardenability solid polymer electrolyte formation ingredient.

[0002]

[Description of the Prior Art] The electrolyte of a liquid has been used for electrochemistry components, such as a primary cell, a rechargeable battery, a capacitor, electrochromic display, and a wet solar battery, from the former. However, a liquid spill occurs in the electrolyte of a liquid and there is a trouble that prolonged dependability is missing in it. Moreover, all solid states are considered from the demand of downsizing etc., a solid electrolyte attracts attention as a new ionic conductor which replaces the conventional electrolytic solution, and the application to all solid-state primary cells, a rechargeable battery, and an electric double layer capacitor is tried briskly (JP,55-98480,A etc.).

[0003] On the other hand, the gel solid polymer electrolyte which confined the electrolytic solution in the macromolecule matrix for the purpose of the improvement in ion conductivity is proposed by JP,55-35420,A. As these production approaches, the approach of adding and carrying out the ultraviolet-rays polymerization of an electrolyte or the electrolytic solution to a giant molecule at the polymerization nature monomer and oligomer containing the approach of adding and carrying out the thermal polymerization of an electrolyte or the electrolytic solution to the polymerization nature monomer and oligomer containing the approach of carrying out the mixed dissolution of the electrolyte and a radical polymerization nature initiator and an optical radical

polymerization initiator etc. is indicated by JP,63-94501,A, JP,63-94563,A, and JP,5-109310,A.

[0004] However, if it originates in a solid polymer electrolyte at a polymerization initiator and charge and discharge are repeated, charge-and-discharge capacity has the trouble of falling rapidly, and the method of removing the polymerization initiator which remains by heat-treatment or sonication is indicated by JP,10-158418,A as a way stage of solution of these problems. However, this approach heat-treats the obtained solid polymer electrolyte which once carried out the polymerization at ultrasonic cleaning or the temperature of 100-300 degrees C, and has the trouble that productivity is bad.

[0005] When forming a gel solid polymer electrolyte, generally Moreover, a polymerization nature constituent, Carry out the polymerization of the constituent containing an electrolytic solution and heat, or a photopolymerization initiator with heat or an activity energy line, and a bridge formation network is formed. It considers as a gel solid polymer electrolyte (JP,10-251318,A etc.). The method of forming on one electrode and building a cell, or it pinches this with two sorts of electrodes is common. After carrying out a polymerization with heat or an activity energy line and forming a bridge formation network, it is difficult to insert the process which removes the polymerization initiator which remains by the approach indicated by JP,10-158418,A.

[0006] On the other hand, the approach of forming a polymerization by the exposure of an electron ray and forming an electrolyte by constructing a bridge is indicated by JP,5-290885,A, JP,5-326019,A, JP,9-17449,A, JP,9-17450,A, and JP,10-112321,A as an approach of not using a polymerization initiator, as the formation approach of a solid polymer electrolyte. Although the above-mentioned fault which ** can also perform the polymerization of a solid polymer electrolyte formation ingredient and bridge formation, and originates in an initiator not using heat or a photoinitiator is solvable, when using an electron ray according to electron beam irradiation, the trouble of constraint of manufacture conditions or reservation of the safety on an activity is held.

[0007]

[Problem(s) to be Solved by the Invention] In approaches, such as JP,55-35420,A which adds an electrolyte or an electrolytic solution to the polymerization nature monomer and oligomer containing the heat or the optical radical initiator of the conventional known, and obtains a solid electrolyte by thermal polymerization or the ultraviolet-rays polymerization, JP,63-94501,A, JP,63-94563,A, and JP,5-109310,A, there was a trouble that originated in a polymerization initiator etc. and charge-and-discharge capacity fell rapidly at the time of the repeat of charge and discharge.

[0008] Moreover, by the approach of removing the polymerization initiator which

remains by performing heat-treatment or sonication after the polymerization indicated by JP,10-158418,A, productivity has bad the trouble that application is difficult, in the gel solid polymer electrolyte.

[0009] On the other hand, as the formation approach of a solid polymer electrolyte of not using a polymerization initiator, although the polymerization and the approach of constructing a bridge are proposed by JP,5-290885,A, JP,5-326019,A, JP,9-17449,A, JP,9-17450,A, and JP,10-112321,A by the exposure of an electron ray, although the above-mentioned fault resulting from an initiator is solvable, when using an electron ray, the new problem of constraint of manufacture conditions or reservation of the safety on an activity is held in them.

[0010] The technical problem which this invention tends to solve is to offer the activity energy-line hardenability solid electrolyte formation ingredient of a liquid, and the activity energy-line hardening approach in the ordinary temperature which does not use the photopolymerization initiator leading to the effluent from a hardening paint film, and is hardened with practical optical reinforcement and an optical exposure.

[0011]

[Means for Solving the Problem] even if this invention persons do not use a photoinitiator with the general-purpose maleimide derivative of specific structure

in the Europe public presentation patent No. 878,482 official report -- ** -- it indicated carrying out a polymerization and copolymerizing with ** (meta) acrylate and vinyl ether by irradiating the ultraviolet rays of practical optical reinforcement.

[0012] this invention persons came to complete a header and this invention for the ability of the solid electrolyte in which whenever [ionic conduction / of the utilization level which was excellent compared with the solid electrolyte system which carried out the polymerization, and which was obtained using the photoinitiator with a general-purpose charge-and-discharge property] is shown to be formed by using maleimide derivative - which has specific maleimide derivative-(Pori) oxyalkylene association, as a result of inquiring wholeheartedly that the above-mentioned technical problem should be solved.

[0013] That is, this invention offers the solid polymer electrolyte formation ingredient characterized by containing the alkylene glycol derivative which has at least one maleimide radical in (I) and (1) electrolyte and (2) molecules (Pori), in order to solve the above-mentioned technical problem.

[0014] Moreover, the alkylene glycol derivative which has at least one maleimide radical in the (II) molecule (Pori) is an alkylene glycol derivative which has two or more polymerization nature functional groups in a molecule (Pori), and this invention provides with the solid polymer electrolyte formation ingredient of a

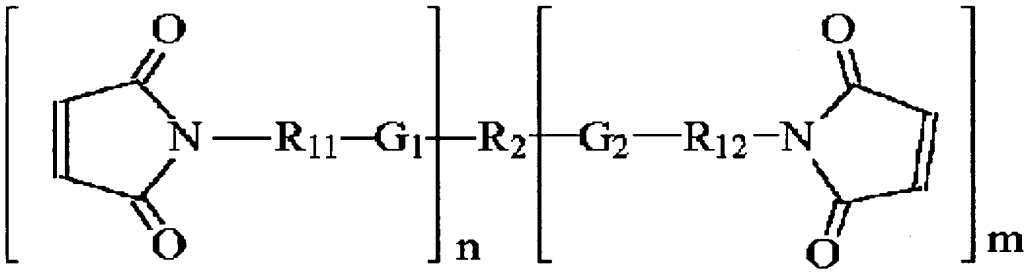
publication the aforementioned (I) term containing the alkylene glycol derivative whose at least one of the polymerization nature functional groups is a maleimide radical (Pori), in order to solve the above-mentioned technical problem.

[0015] In order that this invention may solve the above-mentioned technical problem, moreover, ((III) 1) electrolyte, The alkylene glycol derivative which has one maleimide radical in (2) molecule (Pori), It reaches. It is the alkylene glycol derivative which has two or more polymerization nature functional groups in (3) molecules (Pori). At least one of the polymerization nature functional groups provides with the solid polymer electrolyte formation ingredient of a publication the aforementioned (I) term containing the alkylene glycol derivative which is a maleimide radical (Pori).

[0016] Moreover, for this invention, the alkylene glycol derivative which has at least one maleimide radical in the (IV) molecule in order to solve the above-mentioned technical problem (Pori) is a general formula (1).

[0017]

[Formula 2]



(1)

[0018] (Among a formula, although m and n express the integer of 0-6 which became independent respectively, m+n expresses the integer of 1-6.) R11 and R12 express respectively independently hydrocarbon association containing an aliphatic series radical and/or an aromatic series radical. G1 and G2 express respectively independently ether linkage, an ester bond, a urethane bond, and carbonate association. R2, A straight chain or a branching alkylene group expresses the ether (Pori) joining chain or (Pori) ether residue of average molecular weight 44-10,000 connected with ether linkage. the above (I) which is the compound expressed, and (II) -- or -- (III) A term is provided with the solid polymer electrolyte formation ingredient of a publication.

[0019] Moreover, in order to solve the above-mentioned technical problem, this inventions are compounds other than the alkylene glycol derivative which has (V) maleimide radical (Pori), and provide with the solid polymer electrolyte formation ingredient of a publication the above (I) containing the compound which has a maleimide radical and copolymeric, (II), or (III) the (IV) term.

[0020] Moreover, this invention provides with the solid polymer electrolyte formation ingredient of a publication the aforementioned (V) term which are one or more sorts of compounds with which the compound which has (VI) maleimide radical and copolymeric is chosen from the group which is the vinyl ether compound which has the acrylic ester which has ** (Pori) alkylene glycol chain

(meta), and ** (Pori) alkylene glycol chain, in order to solve the above-mentioned technical problem.

[0021] moreover -- if an electrolyte (VII) chooses from an alkali-metal salt, quarternary ammonium salt, the 4th class phosphonium salt, and a transition-metals salt in order that this invention may solve the above-mentioned technical problem -- **** -- even if few, any 1 term of the - (VI) term containing one sort of electrolytes (aforementioned [I]) is provided with the solid polymer electrolyte formation ingredient of a publication.

[0022] Moreover, in order that this invention may solve the above-mentioned technical problem, any 1 term of the above (I) - a term (VII) is provided with the solid polymer electrolyte formation ingredient of a publication for containing a nonaqueous (VIII) organic solvent.

[0023] Moreover, this invention provides with the solid polymer electrolyte formation ingredient of a publication the aforementioned (VIII) term which are at least one sort of non-aqueous solvents chosen from the group which (IX) nonaqueous organic solvent becomes from a carbonate, lactone, and the ether, in order to solve the above-mentioned technical problem.

[0024] Furthermore, this invention offers the solid polymer electrolyte which becomes any 1 term of a (X) (aforementioned I) - (IX) term from the hardened material of the solid polymer electrolyte formation ingredient of a publication, in

order to solve the above-mentioned technical problem.

[0025] This invention offers the hardening approach of a solid polymer electrolyte formation ingredient of carrying out the polymerization of this solid polymer electrolyte formation ingredient to a solid polymer electrolyte formation ingredient given in any 1 term of a (XI) (aforementioned I) - (IX) term by irradiating an activity energy line under un-existing [of a photopolymerization initiator] further again, in order to solve the above-mentioned technical problem.

[0026] This invention provides with the hardening approach of a publication the aforementioned (XI) term whose activity (XII) energy lines are ultraviolet rays further again, in order to solve the above-mentioned technical problem.

[0027]

[Embodiment of the Invention] The alkylene glycol derivative which has at least one maleimide radical in the molecule used for the solid polymer electrolyte formation ingredient of this invention (Pori) points out that in which the compound containing one by which the straight chain alkylene group and/or branching alkylene group of the carbon atomic numbers 1-6 were combined by ether linkage in the molecule, or those repeat units, and the compound which has at least one maleimide radical carried out the chemical bond. Also in such a derivative, it has two or more polymerization nature functional groups in a molecule, the alkylene glycol derivative whose at least one of the polymerization

nature functional groups is a maleimide radical (Pori) is desirable, and the alkylene glycol derivative which has the maleimide radical especially expressed with the above-mentioned general formula (1) (Pori) is desirable.

[0028] It has two or more polymerization nature functional groups in a molecule, and an acryloyl (meta) radical, an acrylamide (meta) radical, a vinyl group, a vinyl ether radical, etc. are mentioned, for example as polymerization nature functional groups other than the maleimide radical in the alkylene glycol derivative whose at least one of the polymerization nature functional groups is a maleimide radical (Pori).

[0029] In the compound expressed with the above-mentioned general formula (1) preferably used into a molecule as an alkylene glycol derivative which has at least one maleimide radical (Pori), although m and n express the integer of 0-6 which became independent respectively, m+n is the integer of 1-6. Moreover, although R11 and R12 express respectively independently hydrocarbon association which has an aliphatic series radical and/or an aromatic series radical, it is desirable that it is especially an aliphatic series radical. An aliphatic series radical may be a straight chain-like, or may be a letter of branching, and may have the branching ether group etc. here.

[0030] As such R11 and R12, for example A methylene group, ethylene, A trimethylene radical, a tetramethylen radical, a pentamethylene radical, a

hexamethylene radical, A heptamethylene radical, an octamethylene radical, a nonamethylene radical, a deca methylene group, An undecamethylene radical, the straight chain-like alkylene group;1-methyl ethylene radical like a dodeca methylene group, A 1-methyl-trimethylene radical, a 2-methyl-trimethylene radical, a 1-methyl-tetramethylen radical, A 2-methyl-tetramethylen radical, a 1-methyl-pentamethylene radical, a 2-methyl-pentamethylene radical, The alkylene group which has a branching alkyl group like a 3-methyl-pentamethylene radical and a neopentyl radical; A cyclo pentene radical, The cyclo alkylene group like a cyclo hexylene radical; A benzylene group, 2, and 2-diphenyl-trimethylene radical, The aryl alkylene group which has an aryl group in the principal chain or side chain like 1-phenyl-ethylene, 1-phenyl-tetra-ethylene, and 2-phenyl-tetra-ethylene; A cyclohexyl methylene group, Although the cycloalkyl-alkylene group which has a cycloalkyl radical is mentioned to the principal chain or side chain like 1-cyclohexyl-ethylene, 1-cyclohexyl-tetra-ethylene, and 2-cyclohexyl-tetra-ethylene, it is not limited to this.

[0031] Moreover, in the compound expressed with a general formula (1), G1 and G2 express respectively independently ether linkage, an ester bond, a urethane bond, and carbonate association. R2 expresses the ether (Pori) joining chain or (Pori) ether residue of average molecular weight 44-10,000 by which the straight

chain or the branching alkylene group was connected with ether linkage.

[0032] Such R2 If it carries out, for example (a) The straight chain alkylene group of the carbon atomic numbers 1-6 And/ Or one with which the branching alkylene group was combined by ether linkage Or those repeat units One with which the straight chain alkylene group and/or branching alkylene group of the joining chain:(b) carbon atomic numbers 1-6 which consist of ether (Pori) (Pori) all residue of the average molecular weight 44-10,000 which it has were combined by ether linkage, or those repeat units One with which the straight chain alkylene group and/or branching alkylene group of the joining chain:(c) carbon atomic numbers 1-6 with which the ether (Pori) (Pori) oar of the average molecular weight 44-10,000 which it has was connected by the ether group of two to 6 branching were combined by ether linkage, or those repeat units Although the joining chain with which the ether (Pori) (Pori) all radical of the average molecular weight 44-10,000 which it has was connected by the ester bond of two to 6 branching is mentioned, it is not limited to these.

[0033] As ether (Pori) (Pori) oar which constitutes the above-mentioned joining chain (a) For example, ethylene glycol, a propanediol, propylene glycol, The 2-methyl -1, 3-diol, tetramethylene glycol, pentamethylene glycol, Hexandiol, neopentyl glycol, a glycerol, trimethylol propane, Pentaerythritol, diglycerol, a ditrimethylol propane, The alkylene glycol like dipentaerythritol, and these

monoalkyl ether And monocarboxylic acid ester; A polyethylene glycol, a polypropylene glycol, The polyalkylene glycols like a polybutylene glycol and a polytetramethylene glycol, these monoalkyl ether, and monocarboxylic acid ester are mentioned.

[0034] As a joining chain with which the ether (Pori) (Pori) oar which constitutes the above-mentioned joining chain (b) was connected by the ether group of 2 - 6 branching For example, ethylene glycol, a propanediol, propylene glycol, Tetramethylene glycol, pentamethylene glycol, hexandiol, Neopentyl glycol, a glycerol, trimethylol propane, pentaerythritol, Diglycerol, a ditrimethylol propane, the ethylene oxide denaturation object of the alkylene glycol like dipentaerythritol, a propylene oxide denaturation object, a butylene oxide denaturation object, a tetrahydrofuran denaturation object, etc. are mentioned.

[0035] furthermore, as ether (Pori) (Pori) oar which constitutes the above-mentioned joining chain (a) or (b) For example, the copolymer of ethylene oxide and propylene oxide, the copolymer of propylene glycol and a tetrahydrofuran, Ethylene glycol, and the copolymer of a tetrahydrofuran, a polyisoprene glycol, The hydrocarbon system polyols like a hydrogenation polyisoprene glycol, a polybutadiene glycol, and a hydrogenation polybutadiene glycol Although the polyvalent hydroxyl compound like polytetramethylene hexaglyceryl ether (tetrahydrofuran denaturation object of a hexa glycerol) etc. is

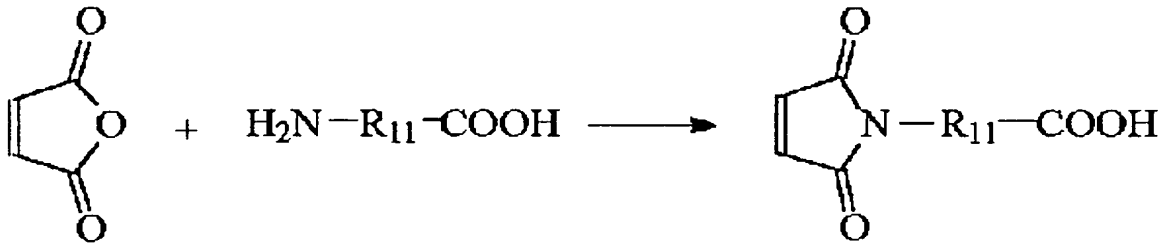
mentioned, it is not limited to these.

[0036] As a joining chain with which the ether (Pori) (Pori) all radical which constitutes the above-mentioned joining chain (c) was connected by the ester bond of 2 - 6 branching For example, (1) A succinic acid, an adipic acid, a phthalic acid, hexahydrophthalic acid, A tetrahydrophtal acid, a fumaric acid, isophthalic acid, an itaconic acid, an adipic acid, A sebacic acid, a maleic acid, trimellitic acid, pyromellitic acid, benzene carboxylic acid, The polycarboxylic acid like benzenehexacarboxylic acid, citric acid, tetrahydrofuran tetracarboxylic acid, and cyclohexane tricarboxylic acid, and (2) Although an esterification object with the ether (Pori) (Pori) oar shown by the above (a) or (b) etc. is mentioned It is not limited to these.

[0037] The maleimide derivative expressed with the general formula (1) used for the solid polymer electrolyte formation ingredient of this invention is compoundable using a well-known technique from the maleimide compound (e-1) which has for example, the maleimide compound (d-1) which has the (d) carboxyl group, and a carboxyl group and the compound (d-2) which reacts to (e) hydroxyl, and hydroxyl and the compound (e-2) which reacts.

[0038] The maleimide compound (d-1) which has a carboxyl group is a reaction formula [0039].

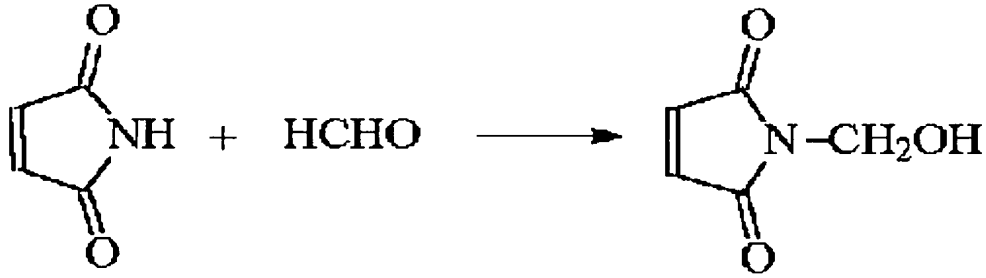
[Formula 3]



[0040] It can come out, and it can compound from a maleic anhydride and the 1st class amino carboxylic acid using a well-known technique (for example, the Europe public presentation patent No. 878,482 official report) etc. so that it may be shown.

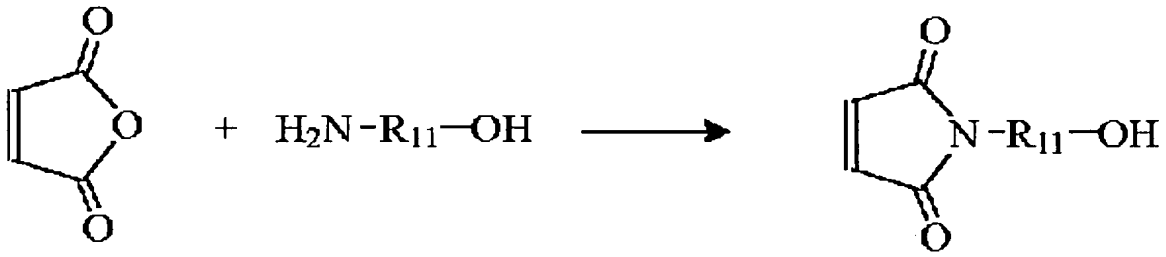
[0041] Moreover, the maleimide compound (e-1) which has hydroxyl is a reaction formula [0042].

[Formula 4]



[0043] It is a reaction formula [0044] from maleimide and formaldehyde so that it may be come out and shown.

[Formula 5]



[0045] It can come out, and it can compound from a maleic anhydride and the 1st class amino alcohol using a well-known technique (for example, the Europe public presentation patent No. 878,482 official report) etc. so that it may be shown.

[0046] As the 1st class amino carboxylic acid used at the above-mentioned reaction For example, an asparagine, an alanine, the beta-alanine, an arginine, an isoleucine, A glycine, a glutamine, a tryptophan, a threonine, a valine, a phenylalanine, A gay phenylalanine, an alpha-methyl-phenylalanine, a lysine, a leucine, A cyclo leucine, 3-aminopropionic acid, alpha-aminobutyric acid, 4-aminobutyric acid, An amino valeric acid, 6-aminocaproic acid, 7-amino oenanthic acid, 2-amino caprylic acid, 3-amino caprylic acid, 6-amino caprylic acid, 8-amino caprylic acid, 2-amino nonoic acid, 4-amino nonoic acid, 9-amino nonoic acid, 2-amino capric acid, 9-amino capric acid, 10-amino capric acid, 2-amino undecanoic acid, 10-amino undecanoic acid, 11-amino undecanoic acid, 2-amino lauric acid, 11-amino lauric acid, 12-amino lauric acid, 2-amino tridecane acid, 13-amino tridecane acid, 2-amino Miss Ching acid, 14-amino

Miss Ching acid, 2-amino pentadecane acid, 15-amino pentadecane acid, 2-amino palmitic acid, 16-amino palmitic acid, 2-amino heptadecanoic acid, 17-amino heptadecanoic acid, 2-amino stearic acid, 18-amino stearic acid, a 2-amino eicosa non acid, Although a 20-amino eicosa non acid, an aminocyclohexane carboxylic acid, aminomethyl cyclohexane carboxylic acid, a 2-amino-3-propionic acid, a 3-amino-3-phenyl propionic acid, etc. are mentioned All can be used if it is not the thing limited to this but the 1st class amino carboxylic acid. Moreover, the lactams like a pyrrolidone, delta-valerolactam, and epsilon caprolactam can also be used.

[0047] As the 1st class amino alcohol used at the above-mentioned reaction For example, 2-aminoethanol, 1-amino-2-propanol, 3-amino-1-propanol, 2-amino-2-methyl-1-propanol, 2-amino-3-phenyl-1-propanol, 4-amino-1-butanol, 2-amino-1-butanol, 2-amino-3-methyl-1-butanol, 2-amino-4-methylthio-1-butanol, 2-amino-1-pentanol, 5-amino-1-pentanol, A methanol, a 6-amino-1-hexanol, (1-amino cyclopentane) A 2-amino-1-hexanol, 7-amino-1-heptanol, 2-(2-aminoethoxy) ethanol, N-(2-aminoethyl) ethanolamine, 4-amino-1-piperazine ethanol, Although 2-amino-1-phenyl ethanol, 2-amino-3-phenyl-1-propanol, a 1-aminomethyl-1-cyclohexanol, an amino trimethyl cyclohexanol, etc. are mentioned All can be used if it is not the thing limited to this but the 1st class amino alcohol.

[0048] Polyol or poly epoxide of one to 6 organic functions of average molecular weight 44-10,000 etc. in which a straight chain alkylene group and/or a branching alkylene group have one combined by ether linkage or those repeat units as a carboxyl group and a compound (d-2) which reacts, for example is mentioned.

[0049] It is the polyol or poly epoxide of one to 6 organic functions of average molecular weight 44-10,000 in which a straight chain alkylene group and/or a branching alkylene group have one combined by ether linkage, or those repeat units as hydroxyl and a compound (e-2) which reacts, for example, and the compound these ends of whose are a hydroxyl group, a carboxyl group, an ester group, an isocyanate radical, a carbonate radical, or a halogen atom is mentioned.

[0050] Although especially the reaction of the maleimide compound (d-1) which has a carboxyl group, and a carboxyl group and the polyol which is one of the compounds (d-2) which react is not limited, it can compound the maleimide derivative expressed with a general formula (1) using a well-known technique (for example, the Europe public presentation patent No. 878,482 official report).

[0051] Although especially the reaction of the maleimide compound (d-1) which has a carboxyl group, and a carboxyl group and the poly epoxide which is one of the compounds (d-2) which react is not limited, it can compound the maleimide

derivative expressed with a general formula (1) using a well-known technique (for example, the Europe public presentation patent No. 878,482 official report).

[0052] Although especially the reaction of the maleimide compound (e-1) which has hydroxyl, and a hydroxyl and the compound (e-2) which reacts is not limited, it can compound the maleimide derivative expressed with said general formula (1) using a well-known technique (for example, the Europe public presentation patent No. 878,482 official report).

[0053] As polyol used as a carboxyl group and a compound (d-2) which reacts For example, ethylene glycol, a propanediol, propylene glycol, Butanediol, a butylene glycol, hexandiol, neopentyl glycol, A glycerol, trimethylol propane, pentaerythritol, diglycerol, A ditrimethylol propane and the alkylene glycol like dipentaerythritol; A polyethylene glycol, The polyalkylene glycols like a polypropylene glycol, a polybutylene glycol, and a polytetramethylene glycol; Ethylene glycol, A propanediol, propylene glycol, butanediol, a butylene glycol, Hexandiol, neopentyl glycol, a glycerol, trimethylol propane, Pentaerythritol, diglycerol, a ditrimethylol propane, The ethylene oxide denaturation object of the alkylene glycol like dipentaerythritol, A propylene oxide denaturation object, a butylene oxide denaturation object, a tetrahydrofuran denaturation object, epsilon-caprolactone denaturation object, a gamma-butyrolactone denaturation object, delta-valerolactone denaturation object, methyl valerolactone

denaturation object;

[0054] The copolymer of ethylene oxide and propylene oxide, the copolymer of propylene glycol and a tetrahydrofuran, Ethylene glycol, and the copolymer of a tetrahydrofuran, a polyisoprene glycol, A hydrogenation polyisoprene glycol, a polybutadiene glycol, Hydrocarbon system polyol; like a hydrogenation polybutadiene glycol polycarbonate polyol; -- acrylic polyol; -- polyvalent hydroxyl compound; like polytetramethylene hexaglyceryl ether (tetrahydrofuran denaturation object of a hexa glycerol) -- the monochrome of the end ether group of the above-mentioned compound containing polyvalent hydroxyl -- And although compound-containing-polyvalent-hydroxyl; etc. is mentioned, it is not limited to these, and all can be used if it is the ether (Pori) oar which has 1-6 hydroxyl groups in a monad (Pori).

[0055] As a carboxyl group and poly epoxide used as a compound (d-2) which reacts For example, ethylene glycol (Pori), propylene glycol (Pori), A butylene glycol, tetramethylene glycol (Pori), (Pori) Glycols, such as neopentyl glycol, poly glycidyl ether of those alkylene oxide denaturation objects; Trimethylol propane, Trimethylolethane, a glycerol, diglycerol, erythritol, The glycidyl ether of aliphatic series polyhydric alcohol, such as pentaerythritol, a sorbitol, 1,4-butanediol, and 1,6-hexanediol, and those alkylene oxide denaturation objects etc. is mentioned.

[0056] As a compound whose end used as hydroxyl and a compound (e-2)

which reacts is a hydroxyl group, a carboxyl group, an ester group, an isocyanate radical, a carbonate radical, or a halogen atom, the carbonate by that and condensation, such as a condensate with the condensate of the above-mentioned (Pori) ether (Pori) oar, they, and a JI - hexa-carboxylic acid or ester, JI - polyisocyanate, etc. and phosgene, a chloro carbonate, an end halogenide, etc. are mentioned, for example.

[0057] As a dicarboxylic acid - hexa carboxylic acid, although a fumaric acid, a phthalic acid, isophthalic acid, an itaconic acid, an adipic acid, a sebacic acid, a maleic acid, a succinic acid, an adipic acid, hexahydrophthalic acid, a tetrahydrophtal acid, the dicarboxylic acid like pyromellitic acid, etc. are mentioned, it is not limited to these, for example.

[0058] As diisocyanate - polyisocyanate For example, methylene di-isocyanate, hexamethylene di-isocyanate, Trimethyl hexamethylene di-isocyanate, tetramethylene di-isocyanate, The aliphatic series diisocyanate compound like lysine diisocyanate and dimer acid diisocyanate; 2, 4-tolylene diisocyanate, The dimer of 2 and 4-tolylene diisocyanate, 2, 6-tolylene diisocyanate, p-xylenediisocyanate, m-xylenediisocyanate, 4, and 4'-diphenylmethane diisocyanate, 1, 5-naphthylene diisocyanate, 3, the 3'-dimethyl biphenyl -4, the aromatic series diisocyanate compound like 4'-diisocyanate; Isophorone diisocyanate, Although the poly isocyanates, such as cycloaliphatic diisocyanate

like 4 and 4'-methylenebis (cyclohexyl isocyanate), methylcyclohexane -2, 4 (2 or 6) diisocyanate, 1, and 3-(isocyanate methylene) cyclohexane, etc. are mentioned It is not limited to these.

[0059] (Pori) As a compound used for carbonate-ization with ether (Pori) oar, diethyl carbonate, carbonic acid dipropyl, phosgene, etc. are mentioned, for example. Moreover, although it can polycarbonate-ize also by the mutual polymerization of epoxide and a carbon dioxide, it is not limited to these.

[0060] As mentioned above, although the maleimide derivative expressed with the general formula (1) used for the solid polymer electrolyte formation ingredient of this invention by the explained process can be obtained, the process of the compound used for this invention is not limited to these.

[0061] Furthermore, into the solid polymer electrolyte formation ingredient of this invention, it is compounds other than the alkylene glycol derivative which has a maleimide radical (Pori), and the compound which has a maleimide radical and copolymeric can be used together.

[0062] Maleimide derivatives other than the alkylene glycol derivative which the compound which has such copolymeric [a maleimide radical and copolymeric] is specifically a compound which has various partial saturation double bonds, for example, has at least one maleimide radical in a molecule (Pori), an acryloyl (meta) derivative, an acrylamide (meta) derivative, a vinyl ether derivative, a

carboxylic-acid vinyl derivative, a styrene derivative, unsaturated polyester, etc. are mentioned.

[0063] As maleimide derivatives other than the alkylene glycol derivative which has at least one maleimide radical in a molecule (Pori) For example, N-methyl maleimide, N-ethyl malei mide, N-propylmaleimide, N-n-butylmaleimide, N-tert-butylmaleimide, N-pentylmaleimide, N-hexyl maleimide, N-lauryl maleimide, 2-maleimide ethyl-ethyl carbonate, The alicyclic monofunctional maleimide;N-phenyl maleimide like 2-maleimide ethyl-isopropyl carbonate and the monofunctional aliphatic series maleimide;N-cyclohexyl maleimide like an N-ethyl-(2-maleimide ethyl) carver mate, N-2-methylphenyl maleimide, N-2-ethyl phenyl maleimide, Aromatic series monofunctional maleimide like N-(2, 6-diethyl phenyl) maleimide, N-2-chlorophenyl maleimide, N-(4-hydroxyphenyl) maleimide, and N-2-trifluoro methylphenyl maleimide;

[0064] - methylenebis maleimide, and N'N, N'-ethylene bismaleimide, [N, and] - trimethylene bismaleimide, and N'N, N'-hexamethylene bismaleimide, [N, and] N, N'-dodeca methylene bismaleimide, 1, alicyclic bismaleimide;N like 4-dimaleimido cyclohexane, N'-(4 and 4'-diphenylmethane) bismaleimide, - (4 and 4'-diphenyl oxy-) bismaleimide, and N'N, N'-p-phenylene bismaleimide, [N, and] N and N'-m-phenylene bismaleimide, N, N' - 2, 4-tolylene bismaleimide, N, N' - 2, 6-tolylene bismaleimide, N, N'-[4 and 4'-bis(3, 5-dimethylphenyl) methane]

bismaleimide, Although N and the aromatic series bismaleimide like N'-[4 and 4'-bis(3, 5-diethyl phenyl) methane] bismaleimide are mentioned, it is not limited to these.

[0065] The compound which has the acryloyloxy radical or methacryloyloxy radical of this invention which can be used together into a solid polymer electrolyte formation ingredient It divides roughly.; (A-1) (Pori) ester (meta) acrylate,; (A-2) urethane (meta) acrylate, ; epoxy (meta) acrylate; (A-4) (Pori) Ether (meta) acrylate, (A-3) ; alkyl (meta) acrylate or alkylene (meta) acrylate, acrylate that has; (A-6) ring (meta); (A-7) (A-5) Although the acrylate which has alicycle structure (meta) is mentioned, it is not limited to these. Also in these, the acrylate compound which has an alkylene glycol (Pori) chain especially (meta) is recommended.

[0066] With the ester (Pori) (meta) acrylate (A-1) which can be used together into the solid polymer electrolyte formation ingredient of this invention As a generic name of the acrylate which has one or more ester bonds in a principal chain (meta), with urethane (meta) acrylate (A-2) As a generic name of the acrylate which has one or more urethane bonds in a principal chain (meta), with epoxy acrylate (A-3) As a generic name of the acrylate which the epoxide and the acrylic acid (meta) of one or more organic functions are made to react, and is obtained (meta), ether (Pori) (meta) acrylate (A-4) As a generic name of the

acrylate which has one or more ether linkage in a principal chain (meta), with alkyl (meta) acrylate or alkylene (meta) acrylate (A-5) As a generic name of the acrylate (meta) which a principal chain is straight chain alkyl, branching alkyl, a straight chain alkylene group, or a branching alkylene group, and may have the halogen atom and/or the hydroxyl group at the side chain or the end With the acrylate (A-6) which has a ring (meta) As a generic name of the acrylate which has a ring in a principal chain or a side chain (meta), with the acrylate (A-7) which has alicycle structure (meta) It uses, respectively as a generic name of the acrylate which has the alicycle structure which may contain the oxygen atom or the nitrogen atom in the principal chain or the side chain per configuration (meta). The acrylate which has an alkylene glycol (Pori) chain also especially in these (meta) is desirable from the point of an ion electric conduction property.

[0067] (Pori) As ester (meta) acrylate (A-1) For example, ethylene glycol (Pori), propylene glycol (Pori), The diol component like tetramethylene glycol, a butylene glycol (Pori), pentanediol (Pori), methyl (Pori) pentanediol, and hexandiol (Pori), (Pori) A maleic acid, a fumaric acid, a succinic acid, an adipic acid, a phthalic acid, hexahydrophthalic acid, A tetrahydrophtal acid, an itaconic acid, a citraconic acid, a beef fat acid, himic acid, A KUROREN Dick acid, dimer acid, an alkenyl succinic acid, sebacic acid, An azelaic acid, 2 and 2, a 4-trimethyl adipic acid, 1, 4-cyclohexane dicarboxylic acid, A terephthalic acid,

2-sodium sulfo terephthalic acid, 2-potassium sulfo terephthalic acid, Isophthalic acid, 5-sodium sulfoisophtharate, 5-potassium sulfoisophtharate, An orthochromatic phthalic acid, 4-sulfo phthalic acid, 1, 10-deca methylene dicarboxylic acid, Acrylate of the polyester polyol which consists of polybasic acid like muconic acid, oxalic acid, a malonic acid, a guru tongue acid, trimellitic acid, and pyromellitic acid (meta); Said diol component and polybasic acid, and epsilon-caprolactone, Although the polyfunctional (Pori) ester (meta) acrylate like the acrylate (meta) of the annular lactone denaturation polyester diol which consists of gamma-butyrolactone, a delta-valerolactone, or a methyl valerolactone is mentioned, it is not limited to these.

[0068] Urethane (meta) acrylate (A-2) is the generic name of the acrylate obtained by the reaction of the hydroxy compound (A-2-1) and isocyanate compound (A-2-2) which have at least one (meth)acryloyloxy radical (meta).

[0069] As a hydroxy compound (A-2-1) which has at least one (meth)acryloyloxy radical For example, 2-hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, 2-hydroxy butyl (meta) acrylate, 3-hydroxy butyl (meta) acrylate, 4-hydroxy butyl (meta) acrylate, cyclohexane dimethanol monochrome (meta) acrylate, Polyethylene-glycol monochrome (meta) acrylate, polypropylene-glycol monochrome (meta) acrylate, TORIMECHI roll pro pansy (meta) acrylate, TORIMECHIRORUETANJI (meta) acrylate, A pen TAERISURITORUTORI

(meta) acrylate or glycidyl (meta) acrylate-(meta) acrylic-acid addition product, The ring breakage reactant of the acrylate compound which has a hydroxyl group like 2-hydroxy-3-phenoxy propyl (meta) acrylate (meta), the acrylate compound which has the hydroxyl group of upper ** (meta), and epsilon-caprolactone etc. is mentioned.

[0070] An isocyanate compound (A-2-2), for example, p-phenylene diisocyanate, m-phenylene diisocyanate, p-xylenediisocyanate, m-xylenediisocyanate, 2, 4-tolylene diisocyanate, 2, 6-tolylene diisocyanate, 4, and 4'-diphenylmethane diisocyanate, 3, 3'-dimethyl diphenyl -4, 4'-diisocyanate, 3, 3'-diethyl diphenyl -4, 4'-diisocyanate, The aromatic series diisocyanate like naphthalene diisocyanate; Isophorone diisocyanate, Hexamethylene di-isocyanate, 4, and 4'-dicyclohexylmethane diisocyanate, one or more kinds of buret objects of the diisocyanate; isocyanate monomer of the aliphatic series like hydrogenation xylenediisocyanate, norbornene diisocyanate, and lysine diisocyanate, or alicycle structure -- or Poly isocyanate like the isocyanurate object which quantified the above-mentioned diisocyanate compound three times; the poly isocyanate obtained by the urethane-ized reaction of the above-mentioned isocyanate compound and various polyols (A-2-3) is mentioned.

[0071] As polyol (A-2-3) used in order to manufacture the poly isocyanate For example, ethylene glycol (Pori), propylene glycol (Pori), The alkylene glycol like

a butylene glycol and tetramethylene glycol (Pori) (Pori); Ethylene glycol, (Pori) A propanediol, propylene glycol, tetramethylene glycol, Pentamethylene glycol, hexandiol, neopentyl glycol, A glycerol, trimethylol propane, pentaerythritol, diglycerol, The alkylene glycol like a ditrimethylol propane and dipentaerythritol An ethylene oxide denaturation object, a propylene oxide denaturation object, a butylene oxide denaturation object, a tetrahydrofuran denaturation object, epsilon-caprolactone denaturation object, a gamma-butyrolactone denaturation object, delta-valerolactone denaturation object, methyl valerolactone denaturation object, etc.;

[0072] The copolymer of ethylene oxide and propylene oxide, the copolymer of propylene glycol and a tetrahydrofuran, Ethylene glycol, and the copolymer of a tetrahydrofuran, a polyisoprene glycol, The hydrocarbon system polyols like a hydrogenation polyisoprene glycol, a polybutadiene glycol, and a hydrogenation polybutadiene glycol; An adipic acid and the aliphatic series dicarboxylic acid like dimer acid, Neopentyl glycol, The aliphatic series polyester polyols which are an esterification reactant with the polyol like methyl pentanediol; Aromatic polyester polyol; which is the esterification reactant of the aromatic series dicarboxylic acid and the polyol like neopentyl glycol like a terephthalic acid polycarbonate polyol; -- acrylic polyol; -- polyvalent hydroxyl compound; like polytetramethylene hexaglyceryl ether (tetrahydrofuran denaturation object of a

hexa glycerol) -- the monochrome of the end ether group of the above-mentioned compound containing polyvalent hydroxyl -- And a compound containing polyvalent hydroxyl; The above-mentioned compound containing polyvalent hydroxyl and a fumaric acid, The compound containing polyvalent hydroxyl obtained according to esterification with a phthalic acid, isophthalic acid, an itaconic acid, an adipic acid, a sebacic acid, and the dicarboxylic acid like a maleic acid; The polyvalent hydroxyl compound like a glycerol, Although an animal, the compound containing polyvalent hydroxyl like the monoglyceride obtained by the ester exchange reaction with vegetable fatty acid ester, etc. are mentioned, it is not limited to these.

[0073] The epoxy (meta) acrylate (A-3) which can be used together into the solid polymer electrolyte formation ingredient of this invention is the generic name of the acrylate which the epoxide and the acrylic acid (meta) of one or more organic functions are made to react, and is obtained (meta). As epoxide (A-3-1) used as the raw material of epoxy (meta) acrylate For example, epichlorohydrin (methyl) and hydrogenation bisphenol A, The hydrogenation bisphenol S, the hydrogenation bisphenols F, those ethylene oxide, The epichlorohydrin denaturation hydrogenation bisphenol mold epoxy resin compounded from a propylene oxide denaturation object etc.; 3, 4-epoxycyclohexylmethyl -3, 4-epoxy cyclohexane carboxylate, Cycloaliphatic epoxy resin like a screw-(3,

4-epoxycyclohexyl) horse mackerel peat; alicyclic epoxide, such as an epoxy resin of the heterocycle content like triglycidyl isocyanurate;

[0074] Epichlorohydrin, and bisphenol A, Bisphenol S (Methyl) Bisphenols F, those ethylene oxide, The epoxy resin; phenol novolak mold epoxy resin; cresol novolak mold epoxy resin of the epichlorohydrin denaturation bisphenol mold compounded from a propylene oxide denaturation object etc.; A dicyclopentadiene and various phenols The epoxidation object of the various dicyclopentadiene denaturation phenol resin which is made to react and is obtained; 2, 2', 6, the epoxidation object of 6'-tetramethyl biphenol, Aromatic series epoxide like phenyl glycidyl ether; (Pori) Ethylene glycol, Propylene glycol, a butylene glycol (Pori), tetramethylene glycol (Pori), (Pori) glycidyl ether [of glycols, such as neopentyl glycol,] (Pori); -- glycidyl ether [of the alkylene oxide denaturation object of glycols] (Pori); -- trimethylol propane -- Trimethylolethane, a glycerol, diglycerol, erythritol, Pentaerythritol, a sorbitol, 1,4-butanediol, Glycidyl ether of the aliphatic series polyhydric alcohol like 1,6-hexanediol (Pori); although the alkylene mold epoxide like the glycidyl ether (Pori) of the alkylene oxide denaturation object of aliphatic series polyhydric alcohol etc. is mentioned, it is not limited to this.

[0075] As ether (Pori) (meta) acrylate (A-4) which can be used together into the solid polymer electrolyte formation ingredient of this invention For example,

butoxy ethyl (meta) acrylate, butoxy triethylene glycol (meta) acrylate, Epichlorohydrin denaturation butyl (meta) acrylate, dicyclopentenyloxy ether (meta) acrylate, 2-ethoxyethyl (meta) acrylate, ethyl carbitol (meta) acrylate, 2-methoxy (Pori) ethylene glycol (meta) acrylate, methoxy (Pori) propylene glycol (meta) acrylate, Nonyl phenoxy polyethylene-glycol (meta) acrylate, nonyl phenoxy polypropylene-glycol (meta) acrylate, Phenoxy hydroxypropyl (meta) acrylate, phenoxy (Pori) ethylene glycol (meta) acrylate, Monofunctional (Pori) ether (meta) acrylate like polyethylene-glycol monochrome (meta) acrylate, polypropylene-glycol monochrome (meta) acrylate, and a polyethylene glycol / polypropylene-glycol monochrome (meta) acrylate;

[0076] Pori ethylene glycol di(metha)acrylate, Pori propyleneglycol di(meth) acrylate, The alkylene GURIKORUJI (meta) acrylate like Pori butylene glycol di(metha)acrylate and polytetramethylene GURIKORUJI (meta) acrylate; The copolymer of ethylene oxide and propylene oxide, The copolymer of propylene glycol and a tetrahydrofuran, the copolymer of ethylene glycol and a tetrahydrofuran, A polyisoprene glycol, a hydrogenation polyisoprene glycol, a polybutadiene glycol, The hydrocarbon system polyols like a hydrogenation polybutadiene glycol, and the polyvalent hydroxyl compound like polytetramethylene hexaglyceryl ether (tetrahydrofuran denaturation object of a hexa glycerol), To one mol of neopentyl glycol, The polyfunctional (meta)

acrylate guided from an acrylic acid; Ethylene oxide one mols or more, (Meta) Di(meth)acrylate of the diol which added and obtained propylene oxide, butylene oxide, and/or the cyclic ether like a tetrahydrofuran;

[0077] Di(meth)acrylate of the alkylene oxide denaturation object of the bisphenols like bisphenol A, Bisphenol F, and Bisphenol S; Hydrogenation bisphenol A, The hydrogenation bisphenol F, the hydrogenation bisphenol S JI of the alkylene oxide denaturation object of which hydrogenation bisphenols (Meta) acrylate; -- di(meth)acrylate [of the alkylene oxide denaturation object of tris phenols]; -- JI of the alkylene oxide denaturation object of di(meth)acrylate;p of the alkylene oxide denaturation object of hydrogenation tris phenols, and p'-biphenol -- Acrylate; The di(meth)acrylate; trimethylol propane of the alkylene oxide denaturation object of di(meth)acrylate;p of the alkylene oxide denaturation object of hydrogenation biphenol, and p'-dihydroxy benzophenones (Meta) Or the monochrome, JI, or Tori (meta) acrylate of the triol which added and obtained ethylene oxide one mols or more, propylene oxide, butylene oxide, and/or the cyclic ether compound like a tetrahydrofuran in one mol of glycerols;

[0078] On pentaerythritol or one mol of ditrimethylol propanes, ethylene oxide one mols or more, The monochrome of triol which added and obtained propylene oxide, butylene oxide, and/or the cyclic ether compound like a tetrahydrofuran, To one mol of dipentaerythritol, JI, Tori, or tetrapod (meta)

acrylate; Ethylene oxide one mols or more, The monochrome of triol which added and obtained propylene oxide, butylene oxide, and/or the cyclic ether compound like a tetrahydrofuran, or the triol of Pori (meta) acrylate, Although the monofunctional (Pori) ether (meta) acrylate of polyhydric alcohol or polyfunctional (Pori) ether (meta) acrylate like tetra-oar, PENTA oar, and hexa oar etc. is mentioned, it is not limited to these.

[0079] As the alkyl (meta) acrylate which can be used together into a solid polymer electrolyte formation ingredient or alkylene (meta) acrylate (A-5) of this invention For example, ethylene glycol di(metha)acrylate, propyleneglycol di(meth) acrylate, 1, 2-butylene glycol di(metha)acrylate, 1, 3-butylene glycol di(metha)acrylate, 1, 4-butanediol di(metha)acrylate, 1,6-hexanediol di(metha)acrylate, The di(meth)acrylate of the hydrocarbon diol like neopentyl glycol di(metha)acrylate; The monochrome (meta) acrylate of trimethylol propane, Di(meth)acrylate or Tori (meta) acrylate ("Pori" is hereafter used as a generic name of many organic functions, such as JI, Tori, and a tetrapod.) Monochrome (meta) acrylate or Pori (meta) acrylate of a glycerol, Monochrome (meta) acrylate or Pori (meta) acrylate of pentaerythritol, Monochrome (meta) acrylate or Pori (meta) acrylate of a ditrimethylol propane, The monochrome (meta) acrylate or Pori (meta) acrylate of polyhydric alcohol like the triol of the monochrome (meta) acrylate of dipentaerythritol or Pori (meta) acrylate,

tetra-oar, and hexa oar etc. is mentioned.

[0080] Next, if the compound which has the vinyl ether radical which can be used together into the giant-molecule solid electrolyte formation ingredient of this invention is divided roughly The alkyl vinyl ether by which the end besides : may be permuted by the halogen atom, the hydroxyl group, or the amino group, (B-1) The cycloalkyl vinyl ether by which the end besides : may be permuted by the halogen atom, the hydroxyl group, or the amino group, (B-2) : At least one radical chosen from the group which consists of the alkyl group, cycloalkyl radical, and aromatic series radical which a vinyl ether radical may combine with an alkylene group, and may have the substituent further, (B-3) Although mono-vinyl ether, the divinyl ether, polyvinyl ether, etc. which have the structure combined through at least one association chosen from the group which consists of ether linkage, a urethane bond, and an ester bond are mentioned The vinyl ether compound which has an alkylene glycol (Pori) chain especially is recommended.

[0081] As a compound which has ether linkage, for example The ethylene glycol methyl vinyl ether, Diethylene-glycol mono-vinyl ether, the diethylene-glycol methyl vinyl ether, The diethylene-glycol divinyl ether, triethylene glycol monovinyl ether, The triethylene glycol methyl vinyl ether, triethylene glycol divinyl ether, Polyethylene-glycol mono-vinyl ether, the polyethylene-glycol

methyl vinyl ether, The polyethylene-glycol divinyl ether, the propylene glycol methyl vinyl ether, Dipropylene glycol mono-vinyl ether, the dipropylene glycol methyl vinyl ether, Dipropylene glycol divinyl ether, tripropylene glycol mono-vinyl ether, The tripropylene glycol methyl vinyl ether, tripropylene glycol divinyl ether, Polypropylene-glycol mono-vinyl ether, the polypropylene-glycol methyl vinyl ether, The polypropylene-glycol divinyl ether, the tetramethylene glycol methyl vinyl ether, JI (tetramethylene glycol) mono-vinyl ether, the JI (tetramethylene glycol) methyl vinyl ether, The JI (tetramethylene glycol) divinyl ether, Tori (tetramethylene glycol) mono-vinyl ether, The Tori (tetramethylene glycol) methyl vinyl ether, the Tori (tetramethylene glycol) divinyl ether, Pori (tetramethylene glycol) mono-vinyl ether, the Pori (tetramethylene glycol) methyl vinyl ether, The Pori (tetramethylene glycol) divinyl ether, the 1,6-hexanediol methyl vinyl ether, JI (hexamethylene glycol) mono-vinyl ether, the JI (hexamethylene glycol) methyl vinyl ether, The JI (hexamethylene glycol) divinyl ether, Tori (hexamethylene glycol) mono-vinyl ether, The Tori (hexamethylene glycol) methyl vinyl ether, the Tori (hexamethylene glycol) divinyl ether, Pori (hexamethylene glycol) mono-vinyl ether, the Pori (hexamethylene glycol) methyl vinyl ether, the Pori (hexamethylene glycol) divinyl ether, etc. are mentioned.

[0082] The vinyl ether compound which has a urethane bond can be obtained by

the urethane-ized reaction of the compound which has at least one isocyanate radical in the mono-vinyl ether of the alkylene glycol which has at least one hydroxyl group in the (f) monad (Pori), and the (g) monad.

[0083] As mono-vinyl ether (f) of the alkylene glycol which has at least one hydroxyl group in a monad (Pori), among these For example, 2-hydroxyethyl vinyl ether, diethylene-glycol mono-vinyl ether, Polyethylene-glycol mono-vinyl ether, 3-hydroxypropyl vinyl ether, 2-hydroxy-2-methylethyl vinyl ether, dipropylene glycol mono-vinyl ether, polypropylene-glycol mono-vinyl ether, 4-hydroxybutyl vinyl ether, 1,6-hexanediol mono-vinyl ether, etc. are mentioned.

[0084] On the other hand as a compound (g) which has at least one isocyanate radical in a monad For example, m-isopropenyl - alpha and alpha-dimethylbenzyl isocyanate, p-phenylene diisocyanate, m-phenylene diisocyanate, p-xylenediisocyanate, m-xylenediisocyanate, 2, 4-tolylene diisocyanate, 2, 6-tolylene diisocyanate, 4, and 4'-diphenylmethane diisocyanate, 3, 3'-dimethyl diphenyl -4, 4'-diisocyanate, 3, 3'-diethyl diphenyl -4, 4'-diisocyanate, The aromatic series isocyanates like naphthalene diisocyanate; Propyl isocyanate, Isophorone diisocyanate, hexamethylene di-isocyanate, 4, and 4'-dicyclohexylmethane diisocyanate, The isocyanate of the aliphatic series like hydrogenation xylenediisocyanate, norbornene diisocyanate, and lysine diisocyanate and an alicycle group etc. is mentioned.

[0085] The compound which has an ester bond among the compounds which have a vinyl ether radical can be obtained by the mono-vinyl ether of the alkylene glycol which has at least one hydroxyl group in the (h) monad, and the esterification reaction of the compound which has at least one carboxyl group in the (i) monad.

[0086] The ingredient explained as a (f) component of the compound which has the above-mentioned urethane bond as mono-vinyl ether (h) of the alkylene glycol which has at least one hydroxyl group is mentioned into a monad.

[0087] As a compound (i) which has at least one carboxyl group, a well-known carboxylic acid and its acid anhydride can be used into a monad. As such a compound, for example A formic acid, an acetic acid, a propionic acid, a valeric acid, A benzoic acid, a maleic acid, a fumaric acid, an itaconic acid, a citraconic acid, a tetrahydrophtal acid, A beef fat acid, himic acid, a KUROREN Dick acid, dimer acid, an adipic acid, An amber acid, an alkenyl amber acid, sebacic acid, an azelaic acid, 2 and 2, a 4-trimethyl adipic acid, 1, 4-cyclohexane dicarboxylic acid, a terephthalic acid, 2-sodium sulfo terephthalic acid, 2-potassium sulfo terephthalic acid, isophthalic acid, 5-sodium sulfoisophtharate, 5-potassium sulfoisophtharate; -- dimethyl - of 5-sodium-sulfoisophtharate, or G low-grade alkyl ester; of the 5-sodium-sulfoisophtharate like diethyl ester -- an orthochromatic phthalic acid -- 4-sulfo phthalic acid, 1, 10-deca methylene

dicarboxylic acid, muconic acid, Oxalic acid, a malonic acid, a glutaric acid, trimellitic acid, hexahydrophthalic acid, a tetrabromo phthalic acid, methyl cyclohexene tricarboxylic acid, pyromellitic acid, or these acid anhydrides are mentioned. furthermore -- these -- a carboxylic acid -- inside -- a monad -- inside -- two -- a piece -- more than -- a carboxyl group -- having -- a compound -- the above -- a urethane bond -- having -- a compound -- (-- g --) -- a component -- ****** -- having mentioned -- isocyanate -- adduct -- the body -- ****** -- having used -- various kinds -- alcohols -- a reaction -- obtaining -- having -- a carboxylic acid -- it can also use .

[0088] As the maleimide radical of others which can be used together into the solid polymer electrolyte formation ingredient of this invention, and a copolymerizable compound, N-isopropyl (meta) acrylamide, the monofunctional (meta) acrylamides like acryloyl morpholine, and the polyfunctional (meta) acrylamides like methylenebis (meta) acrylamide are mentioned as an acrylamide (meta) derivative, for example.

[0089] As a carboxylic-acid vinyl derivative, vinyl acetate, cinnamic-acid vinyl, etc. are mentioned, for example. Moreover, as a styrene derivative, styrene, divinyl styrene, etc. are mentioned, for example.

[0090] As unsaturated polyester, the esterification reactant of the multiple-valued unsaturated carboxylic acid and polyhydric alcohol like a fumaric-acid ester;

maleic acid and a fumaric acid like maleates, dimethyl fumarate, and diethylfumarate like dimethylmalate and diethyl malate etc. is mentioned, for example.

[0091] The vinyl ether which has the acrylate which has an alkylene glycol (Pori) chain especially (meta), and/or (Pori) an alkylene glycol chain in the above-mentioned maleimide radical and a copolymerizable compound is recommended from the point of an ion electric conduction property.

[0092] The hardenability compound which can be used together into the solid polymer electrolyte formation ingredient of this invention is not limited to the above-mentioned compound, if it is a compound which has the maleimide radical of the alkylene glycol derivative which has a maleimide radical (Pori), and copolymeric, does not have especially a limit and can use together one kind or two or more sorts of the compounds.

[0093] Although there is especially no limit in a concomitant use rate when using together the compound which has a maleimide radical and copolymeric into the solid polymer electrolyte formation ingredient containing the alkylene glycol derivative which has the maleimide radical of this invention (Pori), and the maleimide derivative especially expressed with a general formula (1) preferably, from the point of a cure rate, the rate of a compound of having a maleimide radical has 10 desirable % of the weight or more among the polymerization

component of the electrolyte formation ingredient concerned, and 20 % of the weight or more is recommended especially.

[0094] Moreover, from a viewpoint of an ion electric conduction property, as for the content of an alkylene glycol (Pori) derivative, it is desirable all the inside of a polymerization component and that it is 20 % of the weight or more, and it is recommended that it is especially 50 % of the weight or more.

[0095] On the other hand, an electrolyte, an electrode, the maleimide radical that does not react, and the monomer and oligomer which have copolymeric can also be used in order to form the matrix of a solid polymer electrolyte, but if there are too many these amounts of concomitant use, since ion conductivity will fall, 50 or less % of the weight is desirable among [all] a polymerization component, and 20 or less % of the weight is recommended especially.

[0096] Furthermore, it is desirable to use together a monofunctional polymerization nature (Pori) alkylene glycol derivative and a polyfunctional polymerization nature (Pori) alkylene glycol derivative from the point which raises ion conductivity. If , in order to close separation of rigidity and negative electrodes with an enough solid polymer electrolyte, and a positive electrode, as for the concomitant use rate of a monofunctional polymerization nature (Pori) alkylene glycol derivative, it is desirable among [all] a polymerization nature component that it is 5 - 50% of the weight of the range. Although the

polyfunctional polymerization nature (Pori) alkylene glycol derivative of three or more organic functions is useful to formation of a three-dimension matrix, it is recommended from same viewpoint that it is 2 - 30% of the weight of the range.

[0097] If the electrolyte used for the solid polymer electrolyte formation ingredient of this invention is used as a usual electrolyte, there will be especially no limit, and it can be used, for example, an alkali-metal salt, quarternary ammonium salt, the 4th class phosphonium salt, a transition-metals salt, etc. will be mentioned.

[0098] When using the giant-molecule solid electrolyte formation ingredient of this invention for a lithium ion battery or lithium metal cells, the salt containing a lithium ion is desirable. as the salt containing a lithium ion -- LiPF6, LiSbF6, LiAsF6, LiBF4, LiClO4, CF3SO3Li, 2(CF3SO2) NLi, C4F9SO3Li, and C8F17SO3 -- Li and LiAlCl4, etc. -- it is mentioned.

[0099] if the ion used as the carrier with the charge is included when using the solid polymer electrolyte formation ingredient of this invention for an electric double layer capacitor, an electrochromic element, a solar battery, etc. -- **** -- ****ing -- the above-mentioned lithium salt -- in addition, NaClO4, NaI, KClO4, KI, 4(CH3) NBF4, 4(CH3) PBF4, and AgClO4 etc. -- mentioning -- ******.

[0100] When using a solvent for the solid polymer electrolyte of this invention and forming a gel solid polymer electrolyte, if it is the solvent used for a gel solid

polymer electrolyte, it can usually be especially used without a limit. As such a solvent, for example Ethylene carbonate, propylene carbonate, The carbonate system solvent like butylene carbonate, dimethyl carbonate, and diethyl carbonate; Gamma-butyrolactone, gamma-valerolactone, delta-valerolactone, the 3-methyl -1, the lactone system solvent like 3-oxazoline-2-ON; A methylal, The ether system solvent like 1, 2-dimethoxyethane, 1, 2-diethoxy ethane, diethylene-glycol diethylether, an alkoxy polyalkylene glycol, a tetrahydrofuran, and 2-methyl tetrahydrofuran etc. is mentioned.

[0101] An electrolyte can be used in the range which does not exceed the limitation of the solubility to the polymerization nature compound which constitutes an electrolytic solid polymer electrolyte formation ingredient, or the solvent to be used. Although solubility is various and cannot generally be specified with the polymerization nature compound which constitutes a solid polymer electrolyte formation ingredient, and the solvent to be used, in order that an electrolytic solubility critical mass may make whenever [ionic conduction] max, it is usually used. Generally 0.1 - 70% of the weight of the range is desirable to the polymerization nature compound or solvent which constitutes a solid polymer electrolyte formation ingredient, and 1 - 60% of the weight of especially the range is desirable.

[0102] When using as a solid polymer electrolyte which does not contain a

solvent, after dissolving the polymerization nature compound which constitutes an electrolyte and a solid polymer electrolyte formation ingredient in the solvent of a low-boiling point among the above-mentioned non-aqueous solvents, carrying out the cast of this solution to the shape of a high polymer film with one electrode or detachability and distilling off a solvent under reduced pressure, an activity energy line is irradiated and the solid polymer electrolyte of this invention can be obtained. In this case, after distilling off a solvent, it is necessary to adjust to the concentration of the range where an electrolyte does not deposit. Moreover, not using a solvent, it can be made to be able to dissolve in the polymerization nature compound which constitutes a solid polymer electrolyte formation ingredient, and an electrolyte can also be used for it.

[0103] Moreover, when using it as a gel solid polymer electrolyte, the direction of ionic conduction whenever with many additions of an electrolytic solution improves, but since it is in the inclination for the mechanical strength of a solid polymer electrolyte to fall when many [too], it is not desirable. As for the addition of an electrolytic solution, less than [of the polymerization nature compound which constitutes a solid polymer electrolyte formation ingredient / 12 weight twice] is desirable, and below its amount especially of 8 times is desirable.

[0104] The electrode; lithium metal of the bottom acid-ized reduction potential

which uses alkali metal, an alkali-metal alloy, and the alkali-metal ion like a carbon material as a carrier as a negative-electrode active material in using the giant-molecule solid electrolyte formation ingredient of this invention as an electric double layer capacitor or a lithium cell, a lithium aluminium alloy, a lithium lead alloy, a lithium regulus metal, a carbon material; fullerene, such as a natural graphite, an artificial graphite, a gaseous-phase method graphite, petroleum coke, coal corks, pitch system carbon, the poly acene, and C60, etc. is used.

[0105] When using the giant-molecule solid electrolyte formation ingredient of this invention as an electric double layer capacitor or a lithium cell, a metallic oxide, metallic sulfide, a conductive polymer, the electrode material; cobalt oxide of a high oxidation reduction potential like a carbon material, manganese oxide, a vanadium oxide, nickel oxide, molybdenum oxide, a molybdenum sulfide, a titanium sulfide, sulfuration vanadium, etc. are used as positive active material.

[0106] Moreover, a conductive polymer can also be used as forward and/or a negative-electrode active material. As a conductive polymer which can be used for such the purpose, polyacethylene and its derivative, poly para-phenylene and its derivative, poly para-phenylene vinylene and its derivative, polypyrrole and its derivative, the poly thiophene, the derivative and the poly aniline and its derivative, the poly acene, etc. are mentioned, for example.

[0107] When using the giant-molecule solid electrolyte formation ingredient of this invention for electrochromic display, tungsten oxide, a methyl viologen and its derivative, polypyrrole, its derivative, etc. can be used as one electrode active material.

[0108] When using the solid polymer electrolyte formation ingredient of this invention as a wet solar battery, the conductive polymer of the thin film which contains organic coloring matter, such as these inorganic semi-conductors by which coloring matter sensitization was carried out with organic coloring matter, such as inorganic semi-conductors, such as silicon, a zinc oxide, titanium oxide, and a cadmium sulfide, a methyl viologen, a ruthenium bipyridyl complex, a porphyrin, and a phthalocyanine, perylene and its derivative, a porphyrin and its derivative, a phthalocyanine, and its derivative, as one electrode active material, and upper ** etc. is used.

[0109] As an approach of building these devices, using the giant-molecule solid electrolyte formation ingredient of this invention For example, after applying the solid polymer electrolyte formation ingredient of this invention on (1) positive active material, How to carry out the laminating of the negative-electrode active material layer, and to build a device after irradiating an activity energy line and hardening it, After applying the solid polymer electrolyte formation ingredient of this invention on (2) negative-electrode active material, How to carry out the

laminating of the positive-active-material layer, and to build a device after irradiating an activity energy line and hardening it, The solid polymer electrolyte formation ingredient of this invention is infiltrated into (3) nonwoven fabric, a polyethylene mesh, etc. How to carry out the laminating of forward and the negative-electrode active material layer, and to build a device after irradiating an activity energy line and hardening it, Fixed spacing is opened for (4) forward and a negative-electrode active material layer, and the solid polymer electrolyte formation ingredient of this invention is poured in facing each other and between them. Subsequently, method of penetrating forward or a negative-electrode active material layer, irradiating an activity energy line, stiffening the giant-molecule solid electrolyte formation ingredient of this invention, and building a device, The cast is carried out on (5) detachability film, and after irradiating an activity energy line subsequently and stiffening the giant-molecule solid electrolyte formation ingredient of this invention, the method of pinching by forward and the negative-electrode active material layer, and building a device etc. is mentioned.

[0110] As an approach of applying a giant-molecule solid electrolyte formation ingredient, the technique of well-known common use, such as a doctor blade method, a spin coat method, the sinking-in method, the pouring-in method, and the cast method, can be used.

[0111] The solid polymer electrolyte formation ingredient of this invention has the spectral sensitivity of a proper in 200-400nm, and the polymerization of it can be carried out by irradiating ultraviolet rays with a wavelength of 180-500nm or a visible ray under photopolymerization initiator absent, it divides it, and the light of the wavelength which is 254nm, 308nm, 313nm, and 365nm is effective in hardening of the solid polymer electrolyte formation ingredient of this invention. Moreover, the solid polymer electrolyte formation ingredient of this invention can be stiffened also with the exposure of energy lines other than ultraviolet rays, or heat. Furthermore, the solid polymer electrolyte formation ingredient of this invention can be stiffened also in any in air and/or inert gas.

[0112] As an optical generation source of ultraviolet rays with a wavelength of 180-500nm or a visible ray, a low-pressure mercury lamp, a high-pressure mercury lamp, an extra-high pressure mercury lamp, a metal halide lamp, a chemical lamp, a black light lamp, a mercury-xenon lamp, an excimer lamp, a short arc LGT, helium cadmium NIUMU laser, an argon laser, an excimer laser, and sunlight are mentioned, for example.

[0113] Although the solid polymer electrolyte formation ingredient of this invention is hardened by the exposure of ultraviolet rays or a visible ray under photopolymerization initiator absent, in order to perform a hardening reaction more efficiently, it can also add and stiffen the photopolymerization initiator of

well-known common use. It can divide roughly into two sorts, an intramolecular joint cleavage mold and an intramolecular hydrogen length cutting die, as a photopolymerization initiator.

[0114] As a photopolymerization initiator of an intramolecular joint cleavage mold, for example A diethoxy acetophenone, 2-hydroxy - 2-methyl-1-phenyl propane-1-ON, benzyl dimethyl ketal, 1-(4-isopropyl phenyl)-2-hydroxy-isobutane-1-ON, A 4-(2-hydroxy ethoxy) phenyl-(2-hydroxy-2-propyl) ketone, 1-hydroxy cyclohexyl-phenyl ketone, 2-methyl-2-morpholino (4-thiomethyl phenyl) propane-1-ON, The acetophenone system like 2-benzyl-2-dimethylamino-1-(4-morpholino phenyl)-butanone; A benzoin, The benzoins like benzoin methyl ether and benzoin iso-propyl ether; the acyl phosphine oxide system; benzyl like 2, 4, and 6-trimethyl benzoin diphenyl phosphine oxide, methylphenyl GURIOKISHI ester, etc. are mentioned.

[0115] On the other hand, as a photopolymerization initiator of an intramolecular hydrogen length cutting die For example, a benzophenone, methyl o-benzoylbenzoate-4-phenylbenzo phenon, A 4 and 4'-dichloro benzophenone, a hydroxy benzophenone, 4-benzoyl-4'-methyl-diphenyl sulfide, An acrylic-ized benzophenone, 3, 3', 4, and 4'-tetrapod (t-butylperoxy carbonyl) benzophenone, The benzophenone system;2-isopropyl thioxan ton like 3 and 3'-dimethyl-4-methoxybenzophenone, 2, 4-dimethyl thioxan ton, 2, 4-diethylthio

xanthone, 2, the thioxan ton system like 4-dichloro thioxan ton; A Michler's ketone, The amino benzophenone system;10-butyl-2-chloro acridone like a 4 and 4'-diethylamino benzophenone, 2-ethylanthraquinone, 9, 10-phenanthrene quinone, a camphor quinone, etc. are mentioned.

[0116] The loadings in the case of using a photopolymerization initiator have 0.01 - 10.00% of the weight of the desirable range to the polymerization component in a solid polymer electrolyte formation ingredient. From the purpose of this invention, little direction of especially the amount used is good, and 0.01 - 5 % of the weight is recommended.

[0117] Moreover, although the solid polymer electrolyte formation ingredient of this invention is hardened by the exposure of ultraviolet rays, in order to perform a hardening reaction more efficiently, it can also use a photosensitizer together.

[0118] As such a photosensitizer, the amines like triethanolamine, methyldiethanolamine, tri-isopropanolamine, 4-dimethylamino methyl benzoate, 4-dimethylamino ethyl benzoate, 4-dimethylamino isoamyl benzoate, benzoic-acid (2-dimethylamino) ethyl, 4-dimethylamino benzoic-acid (n-butoxy) ethyl, and 4-dimethylamino benzoic-acid 2-ethylhexyl are mentioned, for example.

[0119] The loadings in the case of using a photosensitizer have 0.01 - 10.00% of the weight of the desirable range among a solid polymer electrolyte formation

ingredient.

[0120] Furthermore, into the solid polymer electrolyte formation ingredient of this invention, various nonresponsive compounds etc. can also be suitably used together according to an application.

[0121] Next, a rechargeable lithium-ion battery is explained as an example of the device constituted using the giant-molecule solid electrolyte formation ingredient of this invention. The outline sectional view shown in drawing 1 is an example of a thin lithium secondary battery, and is the structure which was made to harden the solid polymer electrolyte formation ingredient of this invention of 2 by UV irradiation, and pinched it with positive active material 1 and the negative-electrode active material 3. Forward and a negative-electrode active material are formed on the charge collector 4, and are adjusted to 0.1mm of electrolyte membrane thickness by the spacer 5, and the closure is carried out with the insulating resin encapsulant 6. Thus, the closure of the built rechargeable lithium-ion battery is further carried out with the insulating resin encapsulant 7. 8 is lead wire. This example is an example of all the solid state devices built using the giant-molecule solid electrolyte formation ingredient of this invention, and the application range of this invention is not limited by this.

[0122] The solid polymer electrolyte formation ingredient of this invention can form a hardening paint film etc., without using a photopolymerization initiator

together in the case of photopolymerization. Therefore, by using the solid polymer electrolyte formation ingredient of this invention, the conventional photopolymerization initiator can prevent degradation of the device property generated owing to, and is useful for the application of electrochemical devices, such as a primary cell, a rechargeable battery, a capacitor, an erection good ROMIKU display, and a wet solar battery, etc.

[0123]

[Example] Hereafter, although this invention is further explained to a detail using an example and the example of a comparison, this invention is not limited to the range of these examples. In addition, in the following examples, especially"%", as long as there is no notice, "% of the weight" shall be expressed.

[0124] (Example 1) After using polyethylene-glycol (mean molecular weight 400) bismaleimide acetate (abbreviated name: MIAPEG400) and using LiPF6 / ethylene carbonate propylene carbonate (50/50 capacity factor) solution of 0.5 mols / L concentration as this weight, in addition a homogeneity solution as an activity energy-line hardenability compound at this, it applied so that it might become 100 micrometers of thickness on the film made from polyethylene terephthalate (henceforth a PET film).

[0125] The transparent independence film which becomes this constituent from a gel solid polymer electrolyte with a thickness of about 50 micrometers by

irradiating the ultraviolet rays of 900 J/m2 from the high pressure mercury vapor lamp of 120 W/cm was obtained.

[0126] (Example 2) In the example 1, it replaced with MIAPEG400 and the transparent independence film which consists of a gel solid polymer electrolyte with a thickness of about 50 micrometers was obtained like the example 1 except having used polytetramethylene glycol (mean molecular weight 250) bismaleimide acetate (abbreviated name: MIAPTMG250).

[0127] (Example 3) In the example 1, it replaced with MIAPEG400 and the transparent independence film which consists of a gel solid polymer electrolyte with a thickness of about 50 micrometers was obtained like the example 1 except having used polytetramethylene glycol (mean molecular weight 650) bismaleimide acetate (abbreviated name: MIAPTMG650).

[0128] (Example 4) In the example 1, it replaced with MIAPEG400 and the transparent independence film which consists of a gel solid polymer electrolyte with a thickness of about 50 micrometers was obtained like the example 1 except having used the mixture of the weight ratios 1/1 of MIAPEG400 and polyethylene-glycol (mean molecular weight 400) diacrylate (abbreviated-name-EG400DA).

[0129] (Example 1 of a comparison) In the example 1, although ultraviolet rays were irradiated like the example 1 except having replaced with MIAPEG400 and

having used PEG400DA after applying, a polymerization did not happen and the independence film was not obtained.

[0130] When the solid polymer electrolyte formation ingredient of this invention is used, it is clear from examples 1-4 and the example 1 of a comparison that a gel solid polymer electrolyte is obtained and the ingredient of this invention is excellent.

[0131] (Example 5) The glass substrate which has the vacuum evaporationo film which consists of indiumtinoxide (ITO) with a thickness of 0.1 micrometers was used as the electrode, and the cel was manufactured through the 0.14mm spacer. As a photopolymerization nature compound, polyethylene-glycol (mean molecular weight 400) bismaleimide acetate (abbreviated name: MIAPEG400) was used, the solution with which this weight dissolved LiPF6 / ethylene carbonate propylene carbonate (50/50 capacity factor) solution of 0.5 mols / L concentration in this was adjusted, and it poured into the above-mentioned cel.

[0132] The high-pressure mercury lamp of 120 W/cm is used, and it is exposure 24000 J/m2. After irradiating ultraviolet rays through glass with ITO and stiffening a photopolymerization nature compound, the cel was placed all over the glove compartment which enclosed the desiccation argon, 100mV was impressed by the impedance method in 25 degrees C, and the frequency measured 1kHz the conductivity it is [conductivity] o'clock. The frequency of the

solid polymer electrolyte which amended the resistance of an ITO electrode showed 1kHz the conductivity it is [conductivity] o'clock in Table 1.

[0133] (Example 6) In the example 5, it replaced with MIAPEG400, and like the example 5, the conductivity of a solid polymer electrolyte was measured and the result was shown in Table 1 except having used polytetramethylene glycol (mean molecular weight 250) bismaleimide acetate (abbreviated name: MIAPTMG250).

[0134] (Example 7) In the example 5, it replaced with MIAPEG400, and like the example 5, the conductivity of a solid polymer electrolyte was measured and the result was shown in Table 1 except having used polytetramethylene glycol (mean molecular weight 650) bismaleimide acetate (abbreviated name: MIAPTMG650).

[0135] (Example 8) In the example 5, it replaced with MIAPEG400, and like the example 5, the conductivity of a solid polymer electrolyte was measured and the result was shown in Table 1 except having used the mixture of the weight ratios 1/1 of MIAPTMG250 and polyethylene-glycol (mean molecular weight 400) diacrylate (abbreviated-name-EG400DA).

[0136] (Example 2 of a comparison) In the example 5, it replaced with MIAPEG400, and like the example 5, the conductivity of a solid polymer electrolyte was measured and the result was shown in Table 1 except having

used PEG400DA which contains "IRGACURE 184" (photoinitiator) 2% of the weight.

[0137]

[Table 1]

	光重合性化合物	導電率（S／cm）
実施例５	ＭＩＡＰＥＧ４００	1.6×10^{-4}
実施例６	ＭＩＡＰＴＭＧ２５０	8.2×10^{-5}
実施例７	ＭＩＡＰＴＭＧ６５０	1.3×10^{-4}
実施例８	ＭＩＡＰＴＭＧ２５０／ＰＥＧ４００ＤＡ	7.6×10^{-5}
比較例２	ＰＥＧ４００ＤＡ（イルガキュア１８４使用）	2.2×10^{-3}

[0138] It is clear that conductivity's of the gel solid electrolyte which carried out the ultraviolet-rays polymerization of the solid polymer electrolyte formation ingredient of this invention, and obtained it from the result shown in Table 1 it is a value higher than the conductivity of the solid electrolyte which produced polyethylene-glycol (mean molecular weight 400) diacrylate as a polymerization component using the general-purpose photopolymerization initiator.

[0139] (Examples 9-12, example 3 of a comparison) Change of the conductivity

at the time of alternating current impression was observed [******] instead of measuring change of the electrolyte at the time of the repeat of a charge-and-discharge cycle.

[0140] It placed all over the glove compartment held at 25 degrees C which enclosed the desiccation argon with the cel obtained like examples 5-8 and the example 2 of a comparison, 100mV and 1kHz were impressed, the conductivity of 24 hours after was measured, and the result was collectively shown in Table 2.

[0141]

[Table 2]

	光重合性化合物	導電率（S／cm）	
		測定開始時	２４時間後
実施例５	ＭＩＡＰＥＧ４００	１．６×１０$^{-4}$	１．５×１０$^{-4}$
実施例６	ＭＩＡＰＴＭＧ２５０	８．２×１０$^{-5}$	８．１×１０$^{-5}$
実施例７	ＭＩＡＰＴＭＧ６５０	１．３×１０$^{-4}$	１．１×１０$^{-4}$
実施例８	ＭＩＡＰＴＭＧ２５０／ＰＥＧ４００ＤＡ	７．６×１０$^{-5}$	７．３×１０$^{-5}$
比較例２	ＰＥＧ４００ＤＡ（イルガキュア１８４使用）	２．２×１０$^{-5}$	３．５×１０$^{-8}$

[0142] As for the conductivity of the cel of the example 3 of a comparison formed using the general-purpose photoinitiator to the conductivity of the cel formed using the solid polymer electrolyte formation ingredient of this invention hardly

changing from the result shown in Table 2 the time of measurement initiation, and 24 hours after, it is distinct to fall to 10 by about 1/.

[0143] Therefore, it is thought that it does not have the fall of charge-and-discharge capacity, either, since the rechargeable lithium-ion battery formed using the giant-molecule solid electrolyte formation ingredient of this invention is excellent in the stability of the electric conduction property at the time of the repeat of a charge-and-discharge cycle.

[0144] Moreover, the same way, when other electrochemistry components are formed using the solid polymer electrolyte formation ingredient of this invention, it is thought that it excels in stability.

[0145]

[Effect of the Invention] Since the photopolymerization initiator is not used, it is rare also by repeating charge and discharge for the charge-and-discharge capacity of a solid polymer electrolyte to fall.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline sectional view of the rechargeable lithium-ion battery

using the giant-molecule solid electrolyte formation ingredient of this invention.

[Description of Notations]

1 Positive Electrode

2 Solid Polymer Electrolyte

3 Negative Electrode

4 Charge Collector

5 Spacer

6 Insulating Resin Encapsulant

7 Insulating Resin Encapsulant

8 Lead Wire